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SILVICAL LEAFLET 4.

WHITE FIR.

Abies concolor (Gord.) Parry.

White fir is more important for the effect which it may have upon the forest in which it grows than for its commercial value. It is cut less than sugar pine and western yellow pine, with which it commonly grows in California. It is at the same time a more prolific seeder and more aggressive in restocking clearings than either of the pines, facts which tend to increase its proportion in the forest at the expense of the two more valuable trees. Its study is therefore of the greatest silvicultural importance.

RANGE AND OCCURRENCE.

White fir is distributed at moderate altitudes through the mountains of southern Oregon, California, Lower California, Arizona, New Mexico, Utah, and southern Colorado. Like other western conifers with extended ranges, it finds favorable conditions for growth at increasingly higher elevations as it extends southward. On the coast its altitudinal range is from 2,000 to 7,700 feet in Oregon and from 4,000 to 11,500 feet in southern California. In the interior it grows between 5,000 and 9,000 feet in the northern and between 7,000 and 10,500 feet in the southern part of its range.

As a rule the tree prefers northerly exposures, though in the north it is less particular in this respect than in the south. In southern Oregon it is less abundant and grows at higher altitudes on east than on west slopes. In northern California it reaches its best development and grows in densest stand on north and east exposures and about the headwaters of streams. In Utah it is found at lower ele-

vations on northerly aspects and is more abundant on north slopes than on those facing the south. In Arizona, New Mexico, and southern California it is closely confined to northerly aspects wherever it leaves stream beds and canyons.

CLIMATE.

The climate within the range of white fir is moderately humid, and is characterized by extremes of temperature which range from -38° F. in Colorado to 98° F. in southern California, a rainfall of from 19 inches in Colorado to 40 inches in Oregon, with an average of about 25 inches, and heavy winter snows which melt late in spring.

HABIT.

In different localities and in the same locality under different conditions of soil and altitude white fir exhibits considerable variation in size, form, rate of growth, and longevity. In general it is rather a small tree with a conical crown which, except in close stands, reaches well to the ground. In the Rocky Mountains its average height is 70 feet and its diameter about 18 inches. In California, however, it reaches a height of 200 feet and a diameter of 6 feet, while mature timber averages over 100 feet in height and 2 feet in diameter, occasionally with a clear length of 40 or 50 feet.

White fir has a straight stem which tapers rapidly. Its root system is shallow, with strong laterals. Except in youth, the bark is thick and offers considerable resistance to fire. The twigs, branches, and bark of young trees are resinous and inflammable, and its low branching habit affords a ready means for the spread of surface fires to the crown cover. The foliage is persistent for a period of from five to ten years.

White fir is a tree of fairly rapid growth, but is short lived, especially in the Rocky Mountains, where a large proportion of those over 125 years old are decadent. Trees in California occasionally attain an age of from 300 to 400 years.

ASSOCIATED SPECIES.

White fir never forms pure stands over large areas, though in Oregon and northern California it frequently comprises three-fourths of the stand. In the southern Cascades it is scattered through the yellow pine forest with lodgepole and sugar pines, Douglas fir, and incense cedar. Groups of an acre or less of white and Douglas firs in nearly equal proportion occur frequently throughout this forest.

In California white fir is common with yellow, Jeffrey, and sugar pine, incense cedar, and Douglas fir in the lower part of its range,

and with lodgepole pine and California red fir higher up, forming a transition type between these two main types of forest. The stand toward the upper limit of sugar pine is often of great density, which precludes the growth of underbrush and maintains good forest conditions.

White fir is always present in the bigtree groves of the southern Sierras, where, associated with sugar pine, it often forms the underwood. It occurs at high elevations in Lower California, associated with sugar, Coulter, and lodgepole pine, and incense cedar.

White fir is not abundant in the Rocky Mountain forest. It usually occurs as scattered individuals in open stands of yellow pine, Douglas fir, Engelmann spruce, and blue spruce. In Nevada it is associated with yellow and Jeffrey pines; in New Mexico and the San Francisco Mountains of Arizona with yellow pine, Douglas fir, alpine fir, Engelmann spruce, and aspen; and in the Black Mesa Forest in eastern Arizona, in creek bottoms and canyons, with Douglas fir, yellow pine, and Mexican white pine.

SOIL AND MOISTURE.

White fir requires less atmospheric and soil moisture than the other balsam firs, though it makes its best growth in cool and moist situations. The tree does well on almost all soils, except heavy clays, if there is a sufficient supply of moisture. It attains its best development on fairly deep, rich, moist loam, though it often grows on dry, almost pure gravel of disintegrated granite, or even on boulders where no other species could grow.

TOLERANCE.

White fir is extremely tolerant throughout its life. In favorable localities it is usually the most shade-enduring species, and even under unfavorable conditions is only exceeded in tolerance among its associates by Engelmann spruce and alpine fir. By virtue of its tolerance, white fir possesses a close branching habit and cleans poorly. Young growth of white fir is able to survive and to maintain a slow growth under heavy shade, and recovers readily from suppression.

REPRODUCTION.

White fir is, as a rule, a prolific seed producer. The trees begin to bear cones when about 20 years old and produce seed until an advanced age. Usually some seed is borne every year, but in most localities especially heavy production occurs at intervals of about

three years. Trees in the open bear seed earlier and of better quality than those in close stands.

The seed is broad winged, and may be carried a considerable distance by the wind. Little preference is shown with regard to seed bed, and germination takes place on heavy litter and humus as well as in mineral soil. Abundant soil moisture, however, is essential to successful reproduction. The seed possesses a fair degree of vitality. The ability of the seed to germinate and of the tree to grow under widely different conditions renders white fir an aggressive species, and one able to establish a reproduction over denuded lands as well as under its own shade. Half shade, such as that afforded by chaparral, provides ideal conditions for the early stages of seedling growth, a fact which may prove of importance in the reforesting of waste land in California.

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